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STUDY MANUAL

FOR

PESTICIDE APPLICATORS

USING

SODIUM CYANIDE AND THE M-44 DEVICE

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TABLE OF CONTENTS

	Pages
INTRODUCTION	1
HISTORY OF M-44 USE IN MONTANA	1-3
TOXIC EFFECTS OF CYANIDE	3-4
FIRST AID FOR CYANIDE POISONING	4-5
LICENSING AND TRAINING FOR THE USE OF THE M-44 DEVICE	5-6
USE RESTRICTIONS FOR M-44 CYANIDE CAPSULES	6-9
M-44 COMPONENT PARTS AND THEIR USE	9-12
TECHNIQUES FOR PLACEMENT OF M-44 SETS	12-13
PLACEMENT LOCATIONS	13-14
REPORTS	14
BIOLOGY OF THE COYOTE AND RED FOX	14-16
ALTERNATIVES	16-17
APPENDIX I: M-44 SCENT FORMULAS	18-21

LIST OF FIGURES

Figure 1. Department of Livestock M-44 Cyanide Capsule Label 6

Figure 2. M-44 Placement Locations and Species Taken from July 1974 through June 1975 in the Department of Livestock's Experimental Program 13

M-44 STUDY GUIDE

INTRODUCTION

The Montana Departments of Livestock and Agriculture recognize that the ecological impact of predatory animal control is very complex and are continually striving for solutions which will provide for domestic livestock protection, while maintaining environmental quality. The departments acknowledge that predators are resources of inherent interest and value to the people of Montana and our nation, but also recognize the parallel need and responsibility for conducting predator control where resource conflict situations develop. Therefore, the assistance and cooperation of licensed M-44 applicators is an integral part of an overall predatory animal control program and their efforts are deeply appreciated by the departments and the livestock industry.

HISTORY OF M-44 USE IN MONTANA

The first use of M-44's and sodium cyanide for animal damage control in Montana was initiated by the U.S. Fish and Wildlife Service in 1970. They found sodium cyanide used in the M-44 device to be an effective tool for taking wild canids and superior to steel traps in certain respects, primarily in selectivity, manpower, economy and their reliability during some weather conditions which rendered traps less effective. The service's trial use of M-44's terminated on February 8, 1972, when President Richard Nixon instituted Executive Order #11643. This order, "Environmental Safeguards on Activities for Animal Damage Control on Federal Lands," disallowed the use of chemical toxicants for animal damage control on federal lands and the use of these toxicants in federal programs. Following the President's order, the U.S. Environmental Protection Agency, on March 9, 1972, issued Pesticide Regulation Notice 72-2, which prohibited the interstate transportation of certain predacides, including sodium cyanide. Therefore, the only states which could continue using predacides were those in which the product was manufactured within the state and used only on state and/or private lands. Colorado was the only state prepared to manufcture their own sodium cyanide and continued to use this predacide in the humane coyote getter. The remaining states had no alternative but to do without sodium cyanide and other predacides.

On January 9, 1974 the U.S. Environmental Protection Agency announced that Experimental Use Permits for the use of sodium cyanide in the M-44 spring-loaded ejector device for controlling coyotes preying on livestock could be allowed under Section 5 of FIFRA, as amended. The Montana Department of Livestock was granted an Experimental Use Permit on April 4, 1974, to use sodium cyanide spring-loaded ejector mechanisms (M-44's) until October 15, 1975. The U.S. Fish and Wildlife Service was also

granted an Experimental Use Permit on May 30, 1974, but had to comply with the emergency provision under the President's Executive Order #11643 as well. This meant only federal trappers could use M-44's under the U.S. Fish and Wildlife Service's Experimental Use Permit, and no M-44's could be set without substantial livestock losses.

Under the Department of Livestock's Experimental Use Permit, 278 applicators from 22 counties plus the Fort Peck Indian Reservation were trained as state government pesticide applicators and licensed as required under the Montana Pesticides Act.

Between July 1, 1974 and June 30, 1975, a total of 608 coyotes, 148 foxes, 23 skunks, 6 raccooons, 4 dogs and 1 badger was taken by licensed pesticide M-44 applicators in livestock depredation areas under the Department of Livestock's Experimental M-44 Program. Coyotes and foxes are the target species for the experimental program and account for 96 percent of the species taken during the 12-month time interval. The number of coyotes taken each month seemed to compare directly to the number of M-44 units in the field during each month. No specific pattern seems to exist for the taking of nontarget species, but this was probably the result of such a small sample size. Of the four dogs taken during the one-year period, two were predatory in nature and two strayed from their ranch boundaries.

In a questionnaire, applicators indicated that the construction quality of the M-44 device was good (35%) to fair (18%) and the working performance of the M-44 was fair (39%) to good (26%). The M-44 applicators further recorded that sodium cyanide caked after an average of 24 days in the field, that they were successful in taking the target species in livestock loss areas, that registration of sodium cyanide be recommended and that licensed pesticide applicators be granted permission to use M-44's (sodium cyanide). An analysis of additional comments revealed that the M-44 was a valuable tool for predatory animal control, but that it was not the total answer.

After analyzing all data collected during the Experimental Program, the Department of Livestock determined the M-44 device using sodium cyanide had proven to be a selective, efficient, humane, economic and environmentally safe predatory animal control tool.

In July, 1975 the U.S. Fish and Wildlife Service and the Montana Department of Livestock and other western states made application to the Environmental Protection Agency for registration of sodium cyanide M-44 capsules. On August 12-15, an administrative hearing was held by EPA in Washington, D.C. to determine if substantial new information had been collected to warrant the cancellation of EPA Pesticide Regulation Notice 72-2. Russell Train, Administrator of the Environmental Protection Agency, was persuaded by the testimony presented at the hearings to make such

a change. On September 16, 1975, EPA superseded and modified the March 9, 1972 Notice 72-2 to permit the registration of sodium cyanide capsules for use in the M-44 device for the purpose of controlling certain wild canid predators.

The U.S. Fish and Wildlife Service and Department of Livestock were granted M-44 sodium cyanide capsule registration on November 3, 1975 and November 18, 1975, respectively.

TOXIC EFFECTS OF SODIUM CYANIDE

Sodium cyanide is highly toxic and dangerous if not handled properly. Toxic symptoms may occur if it is swallowed, inhaled as a dust, or absorbed through the skin. It is a skin irritant, and solutions of high concentrations may also act as a corrosive agent. In the presence of weak acids, sodium cyanide liberates highly toxic hydrocyanic acid gas.

Sodium cyanide is rapidly absorbed after being swallowed or inhaled as a dust. Skin absorption of sodium cyanide in amounts sufficient to cause poisoning is debatable. However, in the presence of perspiration which is usually acidic, it may react to form hydrogen cyanide which is readily absorbed through the skin. In this manner, it could produce cyanide intoxication. Toxic symptoms appear quickly because of the mechanism of poisoning. The time until death after taking a fatal dose is variable, but usually if death does not occur within an hour, the patient recovers.

Sodium cyanide inactivates the cellular activities and functions of all tissues of the body by "tying-up" certain key cellular enzymes. As a chemical asphyxiant it prevents the utilizaton of oxygen at the cellular level by inhibiting the activity of the tissue oxidative enzymes. Since the function of cellular respiration is necessary to life, any marked degree of interference with it quickly causes serious illness or death. Because of this interference, oxygen cannot be absorbed from the arterial blood by the tissues, with the result that, in severe poisoning, venous blood retains the bright red color of arterial blood.

Following ingestion of sodium cyanide, systemic effects appear quickly. After a large dose, the person may become unconscious within a few seconds. The breathing is at first rapid but soon becomes slow and gasping. Convulsions may occur but in most cases of severe, untreated cyanide poisoning, coma and death occur within a few minutes without the occurrence of convulsions.

After smaller doses, one of the more prominent symptoms is weakness. This may be accompanied by dizziness, confusion, headache and vomiting. These symptoms are rapidly followed by coma and occasionally by convulsions. The heartbeat is weak and irregular; breathing is initially rapid but soon becomes slow and shallow as the intoxication deepens. Milder forms of acute

intoxication will result only in weakness, headache, dizziness and nausea.

The characteristic picture in cyanide intoxication is the rapid onset of coma and cessation of breathing except for the mildest of exposures. If the patient does not die within an hour after ingestion of sodium cyanide, he usually recovers quickly and completely.

FIRST AID FOR CYANIDE POISONING

Prompt treatment of cases involving sodium cyanide poisoning is of the utmost importance. If the patient has breathed sodium cyanide dust, he should be immediately removed to an area free from dust. If cyanide has contaminated the skin or clothing, the clothing should be immediately removed and contaminated skin area flushed with water until all cyanide has been removed.

Someone should be sent immediately to call a physician or plans made for the immediate transport of the patient to a physician.

Maintenance of respiration is the most important initial first aid measure. If breathing has stopped, an effective means of artificial respiration or resusciation should be stared as soon as it is certain that the patient has a clear airway. This is done by examining the mouth to see if the tongue has dropped back. If it has, it should be pulled forward. False teeth, loose bridges, chewing gum, tobacco, etc., should be removed to prevent the patient from choking. Oxygen is recommended and may be administered by anyone properly trained. DO NOT give alcohol in any form.

If the victim is breathing unassisted, amyl nitrite may be administered. Break an amyl nitrite pearl into a cloth and hold lightly under the nose for 15 seconds. Repeat 5 times at about 15 second intervals. Those giving first aid should be careful to keep the broken pearls away from their own mouths and noses because they may inhale the amyl nitrite, become dizzy, and be rendered incompetent to give proper assistance to the poisoned patient. Amyl nitrite should not be used near any source of fire such as an open flame or a cigarette.

Should cyanide granules be taken internally, the patient should be removed to fresh air. If he is conscious, he should be made to vomit by giving him warm salt water (1 tablespoon of salt to each cup of water). This should be repeated until the vomit fluid is clear. To induce vomiting, the victim should be encouraged to stick his finger down his throat. If the victim continues to breathe unassisted, administer amyl nitrite pearls as previously described.

If sodium cyanide has entered the eyes, they should be irrigated immediately with large quantities of water for a minimum of 15 minutes. The eyelids should be held apart during the irrigation

to insure contact of water with all tissues of the surface of the eyes and lids. A physician, preferably an eye specialist, should be called into attendance. If a physician is not available, the eye irrigation should be continued for a second period of 15 minutes. No eye wash should be used in the eyes unless ordered by a physician.

LICENSING AND TRAINING FOR THE USE OF THE M-44 DEVICE

The Montana Department of Agriculture is responsible for the licensing of M-44 applicators. All applicators must undergo specialized training in the use of the M-44 device and pass a writen examination. Training is givin by Vertebrate Pest Specialists from the Montana Department of Agriculture. Training sessions are a day in length including a hands-on, in the field training session and a written examination.

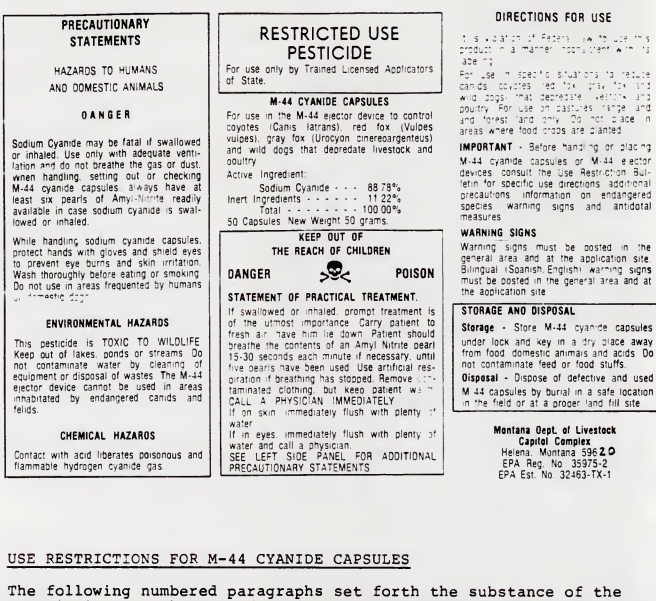
Private or farm applicators licensed to use the M-44 device may use the device only on land owned or leased by the private applicator. There is a $15.00 licensing fee and the private applicator is licensed for a four year period. The applicator must requalify by additional training or examination at the end of that time. Commercial applicators licensed to use the M-44 device may use the device on property that is not their own with the landowner's permission and documentation of livestock losses from wild canids. Commercial applicators must pay a $35.00 annual licensing fee and must requalify by additional training or examination after four years.

Livestock producers requesting the services of commercial M-44 applicators must complete the Livestock Producers M-44 Request Form provided by the applicator. This form documents that producers are experiencing livestock losses from coyotes or fox and gives the applicator permission to place M-44 devices on the producer's property. The landowner, administrator or leasee must provide this information before M-44's are placed on any lands.

All applicators must purchase their own equipment except for antidote kits, warning signs and record keeping forms which shall be provided by the Department of Livestock. The M-44 device and components may be purchased by licensed applicators through the M-44 Company Inc., P.O. Box 876, Fredericksburg, Texas, 78624, or Animal Damage Control, USDA, APHIS, P.O. Box 1938, Billings, MT 59103. Sodium cyanide capsules may be purchased ONLY through the Montana Department of Livestock, Capitol Station, Helena, MT 59620.

The Montana Department of Livestock received Federal Registration of M-44 cyanide capsules on November 18, 1975. The label is shown in Figure 1. It is the responsibility and obligation of the trained licensed applicator to follow the precautionary statements, directions for use and other pertinent information stated on the label.

Figure 1. Department of Livestock M-44 Cyanide Capsule Label.



PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

DANGER

Sodium Cyanide may be fatal if swallowed or inhaled. Use only with adequate ventilation and do not breathe the gas or dust when handling, setting out or checking M-44 cyanide capsules. Always have at least six pearls of Amyl-Nitrite readily available in case sodium cyanide is swallowed or inhaled.

While handling sodium cyanide capsules, protect hands with gloves and shield eyes to prevent eye burns and skin irritation. Wash thoroughly before eating or smoking. Do not use in areas frequented by humans or domestic dogs.

ENVIRONMENTAL HAZARDS

This pesticide is TOXIC TO WILDLIFE. Keep out of lakes, ponds or streams. Do not contaminate water by cleaning of equipment or disposal of wastes. The M-44 ejector device cannot be used in areas inhabited by endangered canids and felids.

CHEMICAL HAZARDS

Contact with acid liberates poisonous and flammable hydrogen cyanide gas.

RESTRICTED USE PESTICIDE

For use only by Trained Licensed Applicators of State.

M-44 CYANIDE CAPSULES

For use in the M-44 ejector device to control coyotes (Canis latrans), red fox (Vulpes vulpes), gray fox (Urocyon cinereoargenteus) and wild dogs that depredate livestock and poultry.

Active Ingredient:

Sodium Cyanide - - -	88.78%
Inert Ingredients - - - - - -	11.22%
Total - - - - - - - -	100.00%

50 Capsules. Net Weight 50 grams.

KEEP OUT OF THE REACH OF CHILDREN

DANGER ☠ **POISON**

STATEMENT OF PRACTICAL TREATMENT.

If swallowed or inhaled, prompt treatment is of the utmost importance. Carry patient to fresh air, have him lie down. Patient should breathe the contents of an Amyl Nitrite pearl 15-30 seconds each minute if necessary, until five pearls have been used. Use artificial respiration if breathing has stopped. Remove contaminated clothing, but keep patient warm. CALL A PHYSICIAN IMMEDIATELY.

If on skin, immediately flush with plenty of water.

If in eyes, immediately flush with plenty of water and call a physician.

SEE LEFT SIDE PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

For use in specific situations to reduce canids' coyotes, red fox, gray fox and wild dogs that depredate livestock and poultry. For use on pastures, range land and forest land only. Do not place in areas where food crops are planted.

IMPORTANT - Before handling or placing M-44 cyanide capsules or M-44 ejector devices, consult the Use Restriction Bulletin for specific use directions, additional precautions, information on endangered species warning signs and antidotal measures.

WARNING SIGNS

Warning signs must be posted in the general area and at the application site. Bilingual (Spanish English) warning signs must be posted in the general area and at the application site.

STORAGE AND DISPOSAL

Storage - Store M-44 cyanide capsules under lock and key in a dry place away from food, domestic animals and acids. Do not contaminate feed or food stuffs.

Disposal - Dispose of defective and used M-44 capsules by burial in a safe location in the field or at a proper land fill site.

Montana Dept. of Livestock
Capitol Complex
Helena, Montana 59620
EPA Reg. No. 35975-2
EPA Est. No. 32463-TX-1

USE RESTRICTIONS FOR M-44 CYANIDE CAPSULES

The following numbered paragraphs set forth the substance of the restrictions on the use of sodium cyanide in conjunction with the M-44 ejector device promulgated by the U.S. Environmental Protection Agency on September 16, 1975.

1. Use of the M-44 device shall conform to all applicable federal, state and local laws and regulations.

2. Applicators shall be subject to such other regulations and restrictions as may be prescribed by the U.S. Environmental Protection Agency.

3. Each applicator of the M-44 device shall be trained in: (1) safe handling of the capsules and device; (2) proper use of the antidote kit; (3) proper placement of the device; and (4) necessary record keeping.

4. M-44 devices and sodium cyanide capsules shall not be sold or transferred to, or entrusted to the care of any person not supervised or monitored by the Montana Department of Livestock and/or Montana Department of Agriculture.

5. The M-44 device shall only be used to take wild canids suspected of preying upon livestock and poultry.

6. The M-44 device shall not be used solely to take animals for the value of their fur.

7. The M-44 device shall only be used in instances where actual livestock losses caused by predation from wild canids are occurring or, based upon documented prior experience indicating a recurring or seasonal predator problem in a specific area, where actual livestock losses caused by wild canid predators can reasonably be expected to occur. In each case, an evaluation will be made and documented so as to include livestock losses and evidence of depredating species prior to application of M-44 devices.

8. The M-44 device shall not be used in: (a) National or State Parks; (b) National or State Monuments; (c) federally designated wilderness areas; (d) wildlife refuge areas; (e) Areas within national forests or other Federal lands specifically set aside for recreational use; (f) prairie dog towns; or (g) areas where exposure to the public and family pets is probable.

9. The M-44 device shall not be used in areas where threatened or endangered animal species might be adversely affected. Each applicator shall be issued a map which clearly indicates such areas.

10. One person other than the individual applicator shall have knowledge of the exact location of all M-44 devices in the field.

11. In areas where more than one governmental agency is authorized to place M-44 devices, the agencies shall exchange placement information and other relevant facts to insure that the maximum number of M-44 devices is not exceeded.

12. The M-44 device shall not be placed within two hundred (200) feet of any lake, stream, or other body of water, provided that natural depression areas which catch and hold rainfall only for short periods of time shall not be

considered "bodies of water" for purposes of this restriction.

13. The M-44 device shall not be placed in areas where food crops are planted.

14. The M-44 device shall be placed at least fifty (50) feet or at a greater distance from any public road or pathway as may be necessary to remove it from the sight of persons and domestic animals using any such public road or pathway.

15. The density of M-44 devices used, shall be the maximum necessary to reduce losses as a rule, but the maximum density of M-44 devices in any 100 acre pasturelands shall not exceed ten (10), and in any one square mile of open range shall not exceed twelve (12).

16. No M-44 device shall be placed within thirty (30) feet of a livestock carcass used as a draw station; no more than four (4) M-44 devices shall be placed at any single draw station; and no more than three (3) draw stations shall be operated in any one square mile of area.

17. The Montana Department of Livestock and/or Montana Department of Agriculture shall check the records, warning signs, and M-44 devices of each applicator at least once a year to verify that all applicable laws, regulations, and restrictions are being strictly followed.

18. Each M-44 device shall be inspected by the applicator at least once a week to check for interference or unusual conditions and shall be serviced as required.

19. Damaged or nonfunctional M-44 devices shall be removed from the field.

20. An M-44 device shall be removed from an area if, after thirty (30) days, there is a cessation of losses caused by target predators in the area.

21. All persons authorized to possess and use sodium cyanide capsules and M-44 devices shall store such capsules and devices under lock and key.

22. Used sodium cyanide capsules shall be disposed of by deep burial or at a proper landfill site.

23. Bilingual warning signs in English and Spanish shall be used in all areas containing M-44 devices. All such signs shall be removed when M-44 devices are removed.

a. Main entrances or commonly used access points to areas in which M-44 devices are set shall be posted with warning signs to alert the public to the toxic nature of the cyanide and to the danger to pets. Signs shall be inspected weekly to insure their continued presence and insure that they are conspicuous and legible.

b. An elevated sign shall be placed within six (6) feet of each individual M-44 device warning persons not to handle the device.

24. Each authorized or licensed applicator shall carry an antidote kit on his person when placing and/or inspecting M-44 devices. The kit shall contain at least six (6) pearls of amyl nitrite.

25. In all areas where the use of the M-44 device is anticipated, local medical people shall be notified of the intended use. This notification may be through a poison control center, local medical society, the public health service, or directly to a doctor or hospital. They shall be advised of the antidotal and firstaid measures required for treatment of cyanide poisoning. It shall be the responsibility of the supervisor to preform this function.

26. Each applicator shall keep records dealing with the placement of the device and the results of each placement. Such records shall include, but need not be limited to:

a. the number of devices placed;
b. the location of each device placed;
c. the dates of each placement, inspection and removal;
d. the number of location of devices which have been discharged and the apparent reason;
e. species of animals taken;
f. all accidents or injuries to humans, domestic animals or nontarget wildlife; and
g. continuous surveillance and documentation of livestock losses caused by wild canids.

Note: The Montana Department of Agriculture's regulations governing the use of the M-44 device in Montana are, in several areas, more specific and/or restrictive than the Federal Use Restrictions and will take precedence over the federal restrictions.

M-44 COMPONENT PARTS AND THEIR USE

The sodium cyanide spring-loaded ejector mechanism or M-44 consists of basically 4 parts: the tube, ejector mechanism, capsule and case holder.

The tube is simply a piece of electrical conduit of varying lengths to which has been attached a Leyerly split ring tube top.

There must be three inches clearance in the tube for the ejector. In wet areas or during periods of heavy rainfall, a small 1/8 inch hole should be drilled in the tube at a point near the bottom of the ejector at least four inches from the top to let moisture out.

Never drive the tube into the ground by hammering directly on the Leyerly top. A pin, consisting of a bolt or rod, should be placed inside the tube against the compacted dirt and used to drive the tube into the ground.

When setting the device, place approximately two inches of dirt inside the base of the tube to form a solid base to assist in driving the tube into the ground without deformation. Then, with a 1/2 inch bolt or rod placed inside the tube against the compacted dirt, use a hammer to drive the tube into the ground about level with the surface. If the ground is hard, use the bolt or rod to make a hole in the ground before driving the tube into the ground. Vibration from the hammer blows while driving the tube can crack the Leyerly top so the tube and bolt should be held to prevent this from occurring. If pliers are used to remove tubes from the ground, grip the tube, not the Leyerly top.

The complete three inch ejector unit consists of the ejector tube, trigger, plunger, and spring. Thrust is provided by the 40-pound compression spring. The plunger is tempered and prelubricated and does not need additional oiling. The critical area of the ejector mechanism is that portion of the ground trigger that, when the trigger arm is depressed, releases the plunger with its full thrust. After repeated firings, the sear contact wears and it becomes "hair triggered" or there may be no contact at all. In checking ejectors, replace all units having faulty sear contact. Ejectors can be refitted with new triggers.

For cocking, place the ejector unit in the setting pliers and press the plunger all the way down. While holding the plunger down, lift the trigger arm up to the small knob on the side of the ejector unit. With the ejector unit still in the pliers, pull the trigger down slightly for a lighter pull to activate the ejector. Move the trigger back and fourth and test it until a crisp trigger release is felt. When testing an ejector, release it in the cocking tool to absorb the shock. Once the ejector unit has been set, place it in the tube previously driven into the ground. Fit the trigger arm in the slot on the side of the tube. Turn the lock ring to the lock ejector in place.

Case holders are used to house the M-44 capsules. All case holders should be checked inside and outside for excess metal particles. These excess metal pieces should be filed off so that they do not prevent insertion of the cyanide capsule into the holder or prevent the cap on the capsule from being released.

Case holders should be wrapped with buckskin, cloth, wool or other materials to cover the metal exposed. Be sure these materials do not have an odor which may repel the target species. These materials should be securely fastened to the case holder and should not extend over the top to prevent escape of the cap.

The M-44 capsule is loaded with 12 grains of granular sodium cyanide mixed with floor dry and potassium chloride (KCL) as a lubricant and to prevent caking. Frequently, a fluorescent tracer is also added to identify animals taken by this device.

The transparent plastic capsule allows for visual checks of the cyanide. A thin layer of plastic has been built into the base which completely seals it from moisture. This base ruptures with a normal plunger thrust. A small air space exists between the cyanide and cap on top of the capsule which allows the cap to be forced off by the ejector unit.

A capsule should not be used unless the cyanide load is loose and the cap is intact. Before using, tap the side of the capsule several times until the cyanide granules "flow" like salt inside the case. If there is solidification, rolling the capsule may rupture the caked cyanide and it may then be trapped loose. When maintaining M-44 lines, capsules should be checked for cyanide looseness at intervals of four to six weeks.

Do not expose the capsules to excessive heat. Under no circumstances should capsules be carried on the dash of a vehicle because of the heat generated there.

Store all capsules in a dry place where there is a minimum of moisture and temperature variation. This adds to the effective life of the capsule. Remember, always keep the capsules under lock and key until used.

In the loading process, the M-44 capsule is inserted into the case holder. Then with the hand cupped over the top of the capsule and case holder, screw the case holder onto the ejector unit. Stay at arm's length keeping the face turned away and upwind from the capsule.

After setting the M-44 device, place scent along the side of the prepared case holder. Placing scent on top of the case holder may prevent release of sodium cyanide from the capsule. Re-scent every two or three weeks, or more often after a heavy rain.

Every time the M-44 ejector device is reset, the plunger should be wiped dry, and it should be kept free from corrosion. If oil on the ejector unit is needed, glycerin or a USP Grade mineral oil that has no detectable odor should be used.

As in steel trapping, a minimum of disturbance of the site and a minimum of human scent left at the site will aid in the taking of the target species.

A thorough knowledge of M-44 parts and the proper setting techniques to be used cannot be gained by a mere word description as set forth in this section on M-44 component parts and their use. Therefore, in the training sessions both class and field demonstration will be conducted.

TECHNIQUES FOR PLACEMENT OF M-44 SETS

M-44 applicators should not expect their devices to automatically take depredating coyotes and fox. Care will have to be taken in the selection of M-44 placement locations in order to achieve good results. Of utmost importance in the placement of M-44's are two factors which cannot be overemphasized. First, M-44's should be placed in areas where coyote and/or fox sign has been located. There is little use in placing M-44 devices in areas where these animals are not traveling. Fresh tracks are the best sign, while droppings, recent livestock kills and dens offer good indication of areas frequented by these predators. Secondly, when preparing an M-44 set, make a clean set and avoid disturbing the surroundings. Foreign odors, litter or a poorly placed M-44 device will alert predators to your presence and generally reduce the effectiveness of these devices. Listed on the next page are some additional recommendations which may provide applicators with some techniques to use in placing M-44 sets.

1. Before placing the M-44 device in the field, the applicator may want to boil the empty tubes and case holders to remove foreign odors from these parts. Never boil the ejector mechanism, as this part is always to remain clean and dry.

2. Maintain prepared case holders (M-44 tops), ejector units and tubes in separate bags or containers. Dirt and scent from the tubes and case holders will gum up the ejector mechanism if they are stored together.

3. A ground cloth may be used while placing M-44's. A clean canvas is recommended. Avoid using materials which may have offensive odors to the target species.

4. Keep one pair of gloves for use when setting M-44's. Gloves used when doing other ranch jobs may pick up foreign odors and repel the target species and should not be used.

5. Make sure your field boots or rubber overshoes are not carrying foreign odors. Applicators who work around shops where grease and oil are present may pick up these odors and transport them into sagebrush and grass while walking to and from M-44 sets.

6. Avoid spitting, discarding cigarette butts or just plain loitering around the M-44 set location.

7. Avoid losing M-44's in deep snow or grass by pacing off the distance between the M-44 device and the stake warning sign.

8. In cattle pastures, use a trench set and cover the M-44 device with a cow chip. This will eliminate the pawing and licking of M-44 devices by these animals.

9. Maintain only enough cyanide capsules on hand to fulfill your needs. Capsules kept more than six months even under the best storage conditions may begin to cake.

10. Sex scents may be placed 10-15 feet from M-44 sets. These scents may draw the target species within areas where M-44's are placed (during certain times of the year only).

11. If the target species has not frequented an M-44 set location for 30 days, pull the M-44 and relocate.

In addition to making a clean M-44 set, the use of effective scents is extremely important. The availability of commercial scents in Montana is somewhat limited and most applicators are forced to develop their own formulas. Probably the best rule of thumb is to change scents until you find what works best in your area during various seasons of the year.

Listed in Appendix I at the back of this study guide are scent formulas which may be usable in Montana. These formulas were developed by trappers throughout the western states for use on M-44's.

PLACEMENT LOCATIONS

During the Department of Livestock's Experimental M-44 Program, applicators provided information concerning placement locations and species taken. From July 1, 1974 through June 30, 1975, this information was categorized for the 22 counties plus the Fort Peck Indian Reservation which participated in the program as indicated in Figure 2.

Figure 2. M-44 placement locations and species taken from July 1974 through June 1975 in the Department of Livestock's Experimental Program.

	M-44 PLACEMENT				SPECIES TAKEN							
PLACEMENT LOCATION	Capsules Initially Placed	Capsules Replaced	Total Capsules Placed and Replaced	Total Capsules Retrieved (Non-fired)	Coyote	Fox	Bobcat	Badger	Skunk	Raccoon	Dog	Other
kill sight	888	251	1139	151	85	20			6	1	1	
sheep pasture	673	142	815	190	36	43			2	1		
cattle pasture	934	110	1044	195	48	10		1			1	
travel trails	2375	394	2769	479	182	30			8	3	1	
old bone piles	935	194	1129	139	101	19			3	1	1	
stock water dam	376	77	453	48	14	12			1			
den area	102	31	133	17	19	6			1			
other	946	184	1130	158	123	8			2			
TOTAL	7229	1383	8612	1377	608	148		1	23	6	4	

Results of the Experimental Program indicated applicators placed M-44's along travel trails and near kill site locations 45 percent of the time. These placement locations accounted for 42 percent of the coyotes and foxes taken during the one-year period. M-44's placed back from draw stations also proved to be successful placement locations. Placement of M-44's in sheep and cattle pastures was primarily associated with attempts to control coyotes and fox on fall and winter ranges where livestock depredation has or was occurring. These locations accounted for 18 percent of the total number of coyotes and fox taken. Placement of M-44's in locations such as old bone piles and stock water dams was done relative to the availability of these site locations in an area and the activity patterns of the coyotes and fox. Applicators also indicated checking for sign, particularly tracks, after periods of snow and rain storms helped in determining coyote and fox travel habits and areas. M-44's could then be placed relative to these findings.

Remember, whatever placement location is decided upon, M-44's must be placed according to the use restrictions previously listed.

REPORTS

M-44 applicators will be required to complete monthly reports as indicated in Figure 3. These monthly reports must be filed with the Department of Livestock by June 30 of each year. Information for these reports can be taken from the M-44 applicator's field diary as indicated in Figure 4. The field diary and monthly reports must be completed on a regular basis and are subject to inspection by the Montana Department of Agriculture and the U.S. Environmental Protection Agency.

BIOLOGY OF THE COYOTE AND RED FOX

Coyotes and red fox are members of the canine family. Coyotes are primarily gray colored, with variations from nearly white, to reddish-brown, to nearly black; the underbelly is a lighter color. Red fox are normally a reddish yellow, darkest on the back with the belly light colored. There are many color variations of the red fox such as the cross (dark area over the shoulder and down the front) and silver (black with white-tipped body hairs and white tip on the tail). Color variations for both species seem somewhat related to the type of habitat in which they live.

Weights vary with areas and food supply, but most adult coyotes weigh from 20 to 35 pounds, while fox average 10 to 20 pounds. Males of both species are slightly larger than the females.

Analyses of stomach contents of 8,263 coyotes from several western states indicated that approximately 50 percent of their diet was rodents and rabbits and 25 percent was carrion. As carnivores, 98 percent of the average coyote diet was animal

matter and 2 percent was vegetable matter. Diet for the red fox consists mainly of available animals ranging in size from insects to rabbits, with mice making up the largest percentage of their diet throughout the year. Berries and other fruits round out their food supply, when available.

Coyotes and red fox usually breed in February and March and produce litters about eight to nine weeks later, in April and May. Females sometimes breed the winter following their birth, at less than one year of age, particularly if the food supply is plentiful. The average litter size is five to seven pups. Coyotes may crossbreed with dogs to produce the coy-dog hybrid. These hybrids are fertile, although their breeding seasons do not usually correspond with those of coyotes.

Distemper and mange are the most common coyote and fox diseases. Rabies and tularemia also occur and may be transmitted to other animals and humans. Some parasites of coyotes and fox are mites, ticks, fleas, worms and flukes. Mortality is highest during the first year of life and few coyotes or fox live more than 10 to 12 years in the wild.

Coyotes and fox are found in nearly all types of terrain, although populations are probably highest in central and eastern Montana. Timber, brush, open prairie and desert areas are favored habitat types, but both species are highly adaptable and are also found in farming areas, suburbs and near cities.

Coyotes and fox are most active at night and during early morning hours, especially where human activity occurs, or during the hot summer months. With minimal human interference, or during cold weather, they are active throughout the day. They bed in sheltered areas, but do not utilize dens except when raising young. They may seek temporary shelter underground in severe weather or when closely pursued. Dens are found in steep banks, rock crevices, sinkholes and underbrush, as well as open areas, but usually are found in areas selected for protective concealment. Dens are often holes that have been used by badger, skunks or other animals, with entrances enlarged to about one foot in diameter. Dens vary in depth from 4 or 5 feet to as deep as 50 feet and may have several openings.

Both parents hunt and bring food, usually regurgitating food for the pups until the pups are several weeks old. Pups begin coming out of the den by three weeks of age, and within two months they follow adults on short hunting trips. Pups are normally weaned by six weeks of age and are frequently moved to find larger living quarters. Extensive travel is common in hunting, although both species hunt the same areas regularly if plenty of food is available. They occasionally bury food remains for later use. The family usually remains together until late summer or fall, when pups become independent, although occasionally they are found as groups until breeding season begins.

Their physical abilities include good eyesight and hearing and an exceptionally keen sense of smell. Although not as fast as greyhounds, they have been measured at speeds of up to 40 miles an hour and can sustain slower speeds for several miles.

Coyotes and fox normally kill smaller mammals by biting the head or neck, but on older lambs and adult sheep, kills are usually made by biting the throat just back of the jaw and ear. Small calves may be killed in a similar fashion, primarily by coyotes. The major cause of death is probably damage to the trachea and/or to nerves affecting respriation, blood pressure and heart rate, rather than the loss of blood.

Coyote and fox kills usually have clean puncture wounds in the head or throat, although coyotes, especially inexperienced pups, occasionally attack the flank or hindquarters. Dogs usually kill by attacking the hindquarters, flanks and head and rarely kill as cleanly as coyotes and foxes. Badly torn and slashed animals with damage to the head, ears and sides are typical of dog predation. Red fox kill and feed on small lambs much the same as coyotes do, but larger sheep often show many teeth marks in the throat. Occasionally, fox pull wool lose from flanks and hindquarters or damage the head as dogs often do. Skinning the hide away from the wound with a sharp knife and exposing the flesh is a reliable way to properly identify the extent of damage caused and the probable predator.

ALTERNATIVES

Alternatives to the use of sodium cyanide in the M-44 device include adversive agents, odor repellents, annoying sounds, chemosterilants or electrical fencing. None of these techniques have proven economical or practical at this time, but they require further evaluation. Additional considerations are for sport hunting and fur trapping, better livestock management practices, compensation of livestock losses, payment of bounty and extention trapping. None of these alternatives, singly or jointly, have provided the protection necessary for livestock producers in preventing or producing depredation by predatory animals.

The final alternative is no predatory animal control. This alternative is not desirable because it implies no protection for domestic livestock and poultry from predatory animals.

Therefore, the use of sodium cyanide in the M-44 device is a practical control technique which should be used to supplement present shooting, trapping and denning control methods. Adequate laws are presently in force for the selective, safe, efficient and humane use of this predacide. The laws and agencies responsible are as follows:

1. Federal Insecticide, Fungicide and Rodenticide Act, 1947, as amended by the U.S. Environmental Protection Agency.

2. Montana Pesticides Act, 1971, as amended -- Montana Department of Agriculture, Environmental Management Division.

3. Montana Environmental Policy Act, 1971 -- Montana Environmental Quality Council.

No.1

Rotted fish (carp or sucker)	4 qts.
Beaver castors	8 tsp.
Artificial musk (amberette)	4 tsp.
Glycerine	20 oz.
Flour	1.5 lb.

No. 2

Same as No. 1 except 1 oz. Canton musk substituted for the artificial musk.

No. 3

Rotted fish (carp or sucker)	1 gal.
Cattle blood, fresh	1 gal.
Beaver castor	2 Tbs.

No. 4

Horse meat (rotted)	1 gal.
Cattle blood, fresh	1 gal.

No. 5

Same as No. 2 except substitute Tonquin musk for Canton musk.

No. 6

Muskrat (rotted)	1 qt.
Beaver castor	2 tsp.
Artificial musk (amberette)	1 tsp.

No. 7

Muskrat (rotted)	1 qt.
Beaver castor	2 tsp.
Tonquin musk	1/4 oz.

No. 8

Muskrat (rotted)	2.5 qts.
Pork blood, fresh	1 qt.

No. 9

Egg yolks (rotted)	12
Beaver castor	1 tsp.
Tonquin musk	1 tsp.

Separate egg yolks and whip them. Allow them to decay. Then add other ingredients.

No. 10

Milt special

Canton musk	2 tsp.
Beaver castor	6 tsp.
Bone marrow	6 tsp.
Artificial musk (amberette)	1 tsp.

No. 11

Milt mix

Elk brains (rotted)	6 tsp.
Bone marrow	3 tsp.
Beaver castor	3 tsp.
Glycerine	1 tsp.

No. 12

Oil of Rodium	1 oz.
Valerian oil	1 oz.
Amberette	1 oz.

Combine the above ingredients and use in such scent bases as boned and partially dried fish which has been thoroughly ground. Used in the proportion of 3 to 6 drops of the drug mixture to the pint has proven very satisfactory when used in seal oil.

No. 13

Horse meat	1 gal.
Fish	1 gal.
Beaver meat	1 gal.

Place in wooden or glass containers, partially decompose and stop decomposition by adding 3 tsp of benzoate of soda. The material need not be very rotten. Add: 3 small beavers, 2 tsp white musk, 2 drops oil of anise, 1 pint mineral oil.

No. 14

Fox and mink food	1 gal.
Mink or muskrat	1 gal.
Tonquin oil	1 tsp.
Benzoate of soda	3 drops
Horse meat	1 tsp.
Beaver castor	1 gal.
Skunk musk	1
Mineral oil	3 drops
	1 pint

No. 15

Horse meat	1 gal.
Beaver castor	1
Skunk musk	3 drops
Mineral oil	1 pint

No. 16

Horse meat	1 qt.
Beaver castor	1/2 tsp.
Mineral oil	1 pint
Beaver tails	2
Asfetida powder	1/2 tsp.
Benzoate of soda	1 tsp.

No. 17

Eggs	1 doz.
Milk	1 can
Brains	1/2 pint

No. 18

Horse meat	1 qt.
Mink or muskrat	1 qt.
Beaver castor	1/2
Blood	1 qt.
White musk (xylol)	1 tsp.
Benzoate of soda	1 tsp.
Mineral oil	1 pint

No. 19

Goat meat (well decomposed)	1 gal.
Mineral oil	1 pint
Musk (xylol)	1 tsp.
Beaver castor	1
Benzoate of soda	1 tsp.

No. 20

Salmon	1 gal.
Seal meal	1 gal.
Musk (xylol)	1 tsp.
Catnip oil	3 drops
Benzoate of soda	1 tsp.
Blood	1 gal.
Beaver castor	1
Oil of anise	3 drops
Mineral oil	1 pint

No. 21

Horse blood (6 mo. old)	1 pint
Beaver castor	1
Siberian or white musk	1/2 tsp.
Oil of anise	2 drops
Glycerine	1/2 pint

No. 22

Eggs (rotted)	1/2 qt.
Bone Marrow	1/4 qt.
Field Mice (rotted)	1/4 qt.

Take eggs that have failed to hatch. A few with dead chicks are desirable. Field mice to be ground and rotted. Bone marrow preferably from carcasses that are stale or allowed to stand over winter. Egg should rot for two years.

No. 23

Horse meat	1/4 qt.
Field mice, rotted	1/4 qt.
No. 22 (described previous)	1/2 qt.

No. 24

Muskrat, rotted	2 qts.
Catfish, rotted	1 qt.
Fresh blood	1 pint
Milk, rotted	3 Tbs.

Beaver may be substituted for muskrat. The mink should be rotted for 3 years.

No. 25

Beaver fat, rendered	2 qts.
Beaver castors, powdered	2

Add beaver castor to beaver fat and allow to stand. It is white at first but becomes an orange-yellow.

No. 26

Horse meat(rotted), ground	1/2 gal.
Mixture made up of 2/3 rotted ground fish and 1/3 beef blood rotted with fish.	1/2 gal.
Beaver castor, powdered	6 tsp.

No. 27

Dry horse meat powdered in seal oil to form a pasty consistency. Horse hair cut to 1/2 in. or shorter added to base. Add Tonquin musk.

No. 28.

Lanolin (anhydrous)	3 oz.
Seal oil	3 oz.
Mink musk	1/2 oz.
Beaver castor, powdered	1/2 oz.
Civette	3 grains

Mix lanolin and seal oil, add mink musk and mix. Add civette and mix. Add beaver castor.

No. 29

Horse fat, rendered	1 qt.
Beaver castors, powdered	3 oz.

Mix indgredients and allow to set for a month before using.

No. 30

Seal oil	8 oz.
Lanolin (anhydrous)	6 oz.
Oil of Rhodium	6 grains
Oil of Valerian	6 grains
Musk Amberette	15 grain

No. 31

Hog brains, decayed	1 qt.
Red salmon(no. 2 can or 1 tin sardines in oil.	1
Oil of Valerian	7 drops

Mash the fish to paste and stir into brains. Add valerian and mix.

No. 32

Hog brains, decayed 1-2 years	1 qt.
Musk Amberette	1/4 tsp.
Rhodium Oil	10 drops
Valerium Oil	10 drops

No. 33

Sardines in oil	20 oz.
Horse blood, coagulated	20 oz.
White sugar	32 oz.
Glycerine	40 oz.
Mink musk	4 oz.
Beaver castor, powdered	4 oz.
Civette	40 gr

Drain oil from sardines. Macerate sardines to paste. Thin cevette in oil. Add and mix in the following order: civette, mink musk, blood, castorium, sugar, glycerine. Mix well.

No. 34

Horse fat, rendered	48 oz.
Seal oil	32 oz.
Seal meat	32 oz.
Beaver castor, powdered	8 oz.

No. 35

Fresh fish, ground	2 lb.
Skinned beaver, ground	2 lb.
Beaver castor, powdered	1/4 lb.
Mink musk	1/4 lb.
Seal oil-anhydrous lanolin 2 to 1 mixture	2 lb.
Aureomycine	500 mg.

Mix fish and beaver. Mix aureomycine in 1 pt water. Add to fish-beaver mix. Warm lanolin and add seal oil. Add mink musk and beaver castor. Add oil to beaver-fish mixture and mix. Stir once a day for 3 days.

No. 36

Fresh fish	2 oz.
Blood, coagulated	2 oz.
Mink musk	1/4 oz.
Beaver castor	1/4 oz.

Behead fish and clean, Dry 3 days. Grind. Pour serum off blood. Mix with fish.

No. 37

Fish, partially dried, ground	2 lb.
Anhydrous lanolin	6 oz.
Seal oil	6 oz.
Mink musk	4 oz.
Beaver castor, powdered	4 oz.
Aureomycine	200 mg.

Warm lanolin and add seal oil. Dissolve aureomycine in water. Stir into fish. Add mink musk and castorium to seal oil-lanolin mix. Add to fish. Stir well.

No. 38

Fish, ground	50 lb.
Aureomycine	2 mg.
Beaver castor, powdered	1
Mink musk	25 oz.
Seal oil and lanolin mix 2 to 1	15 lb.

Partially dry fish, grind. Mix aureomycine in 2 qts. water. Mix with fish. Warm lanolin. Add to seal oil. Add castorium and mink musk to oil. Add oil to fish.

No. 39

Horse meat, ground	2 gal.
Fresh fish, ground	1 gal.
Sour dough	1 gal.
Musk, synthetic	4 tsp.
Baking soda	4 Tbp

Mix ingredients well and let stand 4 weeks. Soak 2 pairs beaver castors in 1 qt. of grain alcohol 4 weeks. Add to above mixture. Add 3-4 gals. mineral oil. Add 2 skunk scent glands and let stand 1 week before use. Be sure to use large container because mixture will swell.